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Forest Service Leaders in Conservation Research

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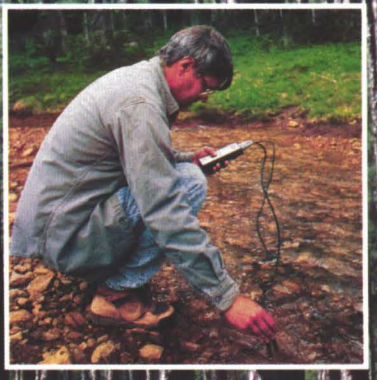

United States Department of Agriculture
Forest Service
FS-528

Thoughtful Americans are asking serious questions about our Nation's forests:

- Are forests threatened by air pollution or climate change?
- Are endangered species being protected?
- Is biological diversity being maintained?

Because of its large and dynamic research organization, the Forest Service in the U.S. Department of Agriculture knows a great deal about these and other questions related to the protection, management, and use of America's forests.

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We who work in Forest Service Research are proud of our capability, our commitment, and our record of achievement. This publication tells a little about us. It describes our purpose and how we are organized, and it introduces some of our leading scientists. If you would like to know more, please do not hesitate to write. We love to talk about our work.

We are the world's largest conservation research organization. Among our number are more than 700 full-time scientists, with enough Ph.D.'s to staff a rather large university. Our scientists represent a surprising number of the biological, physical, and social sciences—entomology, botany, ecology, hydrology, engineering, physics, chemistry, economics, and sociology, to name a few.

To support our research scientists, we have a large number of clerical, technical, and administrative specialists. It is their job to provide whatever is needed to speed up the search for new knowledge.

Our primary jobs are to monitor conditions on private and public forests throughout the United States, to identify problems, and to find practical solutions. There are more than enough problems to go around, so we work closely with hundreds of cooperators in universities, other government agencies, forest industry, and conservation groups. We also conduct basic research to advance our technical knowledge base. This allows us to deal more effectively with emerging management problems and policy issues.

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AA 92-149 FRONT COVER PHOTOS: AA 92-143, Upper–AA 92-144, Mid-left–AA 92-145, Mid-right–AA 92-146, Lower–AA 92-147. BACK COVER: AA 92-148

Mission

The mission of Forest Service Research is to serve society by developing and communicating the scientific information and technology needed to protect, manage, and use the natural resources of forest and range lands for the benefit of a diverse public.

Our mission statement contains three key messages:

First, it commits us to succeed. It does not just say that we will try hard. It says that we will develop and communicate the needed information and technology.

Second, it says that our science does not stop at the laboratory door. We must communicate our results to the landowners and land managers who are responsible for natural resources.

Third, it says that we will help decisionmakers in their endless search for an appropriate balance between resource protection and resource use.

Forests and grasslands dominate the ecology of much of our Nation. The way they are managed controls what our landscapes look like and what plants and animals live in them. But those forests and grasslands also please us with their beauty and solitude and provide raw materials for our country's industrial base.

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Land managers must seek delicate balances between conflicting interests. They must try to preserve the beauty of the forest while they are harvesting timber. In providing habitats, they must consider people as well as plants and animals. In this search for balance, there may be no perfect or permanent solutions. In Forest Service Research, we are proud to be providing the information land managers need to make their difficult decisions.

The Forest Service recently formulated its research strategy for the 1990's. It is based on our abilities and the needs of our clients. Over the next decade, our research will have three primary components:

Understanding ecosystems. People are talking a lot about ecology, but our knowledge about forest ecology is far from complete. Research topics in this field include ecological processes, biological diversity, endangered species, global change, atmospheric deposition, surface and ground water pollution, reforestation, and tropical forestry.

Understanding relationships between people and natural resources. The human component is one of the most difficult problem managers of public land have to deal with. Research topics in this field include socioeconomic aspects of fire at urban/wildland interfaces, rural development and diversification, international trade, understanding relationships of people and natural resources, differences in values of user groups, and influences of urban culture on natural resource management.

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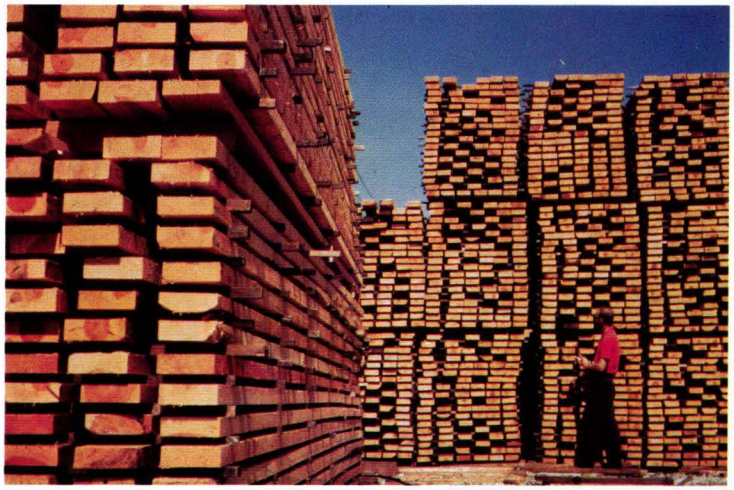
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Understanding and expanding resource options. Natural resource managers are looking for innovative approaches to help meet the increasing demands for wood products and their uses. We will study innovative systems and practices, particularly those designed to increase the enjoyment and protection of water, fish, wildlife, and recreation resources of forests and grasslands. Research to improve utilization of existing wood supplies and recycling of wood products will also be emphasized.

To find out more about Forest Service Research, write to Dr. Jerry A. Sesco, Deputy Chief for Research, USDA Forest Service, P.O. Box 96090, Washington, DC 20090

Organization

Like the rest of the Forest Service, we in the Research branch have a decentralized organization. As much authority as possible is concentrated at the lowest possible levels in the organization. Practical problems occur in individual forest stands and ecosystems, so that is where we must focus our attention. Our research results must account for differences among ecosystems if they are to be useful to land managers.

To account for geographic differences, we are divided into eight regional experiment stations, which are responsible for different forested areas in the United States. These regional experiment stations are headquartered in Radnor, Pennsylvania; St. Paul, Minnesota; Asheville, North Carolina; New Orleans, Louisiana; Ogden, Utah; Fort Collins, Colorado; Portland, Oregon; and Albany, California (figure 1). Much of our forest products manufacturing and utilization research is centered at the Forest Products Laboratory in Madison, Wisconsin.

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Our research approaches and emphases vary considerably among regions. Land managers in western Montana, where timber rotations often exceed 100 years, do not ask the same questions as Georgia tree farmers, who often harvest forest plantations when the trees are less than 35 years old.

The range of human curiosity about forests may be limitless, but our research budget is not. Our research activities, therefore, are carefully planned to avoid duplication of effort and to focus on the most important problems. Although some variations occur, the administrative structure that provides this focus generally includes:

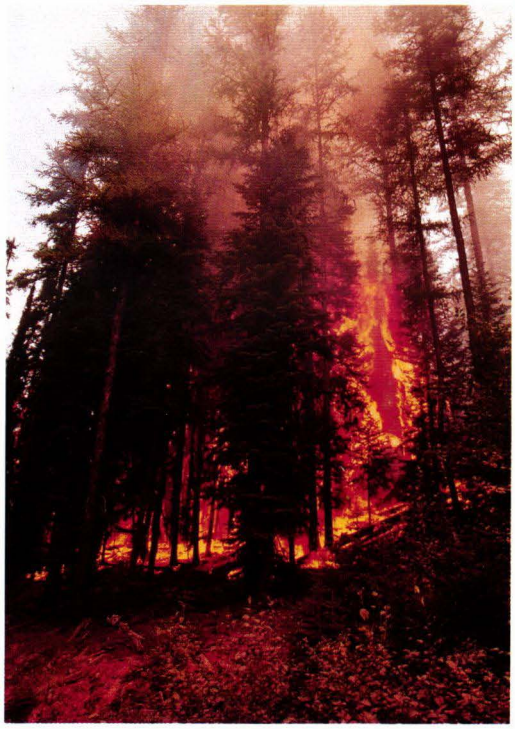
National level. A deputy chief for research and a staff of subject matter specialists in forest environment; forest fire and atmospheric sciences; forest insects and diseases; forest products and harvesting; forest inventory, economics, and recreation; and forest management.

Regional level. A station director; one or more deputy station directors and/or assistant station directors for research, administration, and research planning and applications; and managers of special research, development, and application programs.

Local level. Project leaders and program managers, who supervise groups of scientists in research work units.

Project leaders and program managers are chosen for their demonstrated research and administrative skills. They identify specific research problems, and they plan and execute studies to solve those problems. People at the regional and national levels help

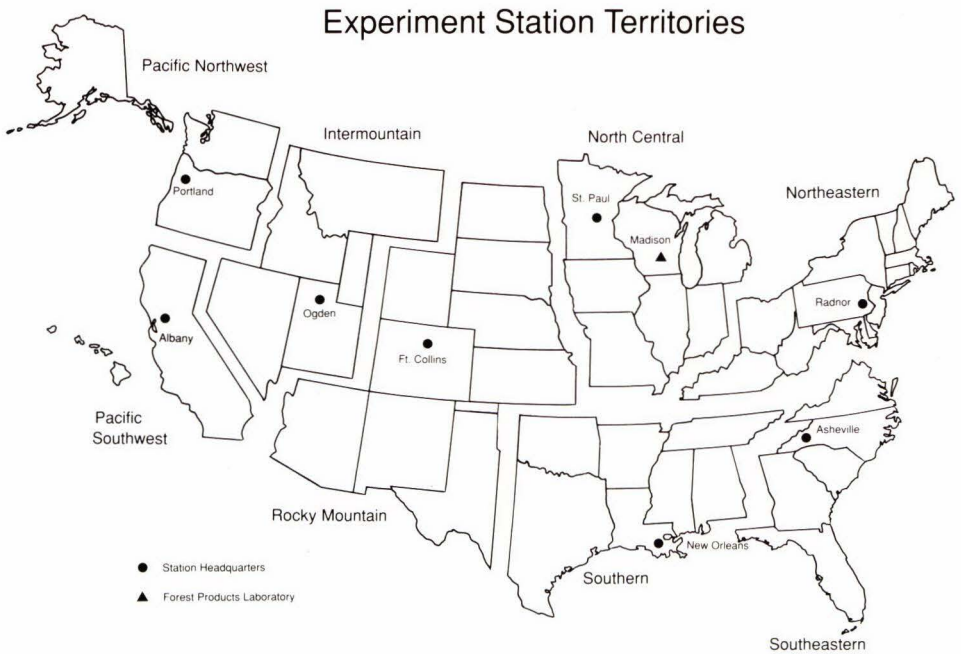
to identify problems, plan studies, and review progress each year. But project leaders and program managers, more than anyone else, are most familiar with studies that are underway. Thus, if you have questions about specific studies, they are most likely to know the answers.



At intervals of about 5 years, the missions of research work units are reviewed and revised. In these reviews, we consult with scientific colleagues as well as the land managers and others who use our findings. Their presence ensures that our studies have high priority and that our results will be used.

Scientists from government, universities, and industry have a common understanding that the problems we are addressing are too important to permit territorial disputes or duplication of effort. Formally and informally, therefore, we share our plans with other people who are working on similar problems.

Our research work units are scattered widely across the Nation. Many are housed on university campuses where our scientists can interact closely with colleagues in academia. Others are located near users of technology to ensure rapid adoption of new scientific discoveries. Still others are located near experimental forests, lands that have been set aside specifically for forest research. These experimental forests are essential for long-term studies under carefully controlled conditions. Some of the oldest forest research plots in America are maintained there. These plots show how forests respond to common treatments over the long term.



Tradition for Success

People often ask when the Forest Service created its research arm. In fact, forest research in the U.S. Department of Agriculture predates the formation of the Forest Service and the establishment of national forests by many years. The USDA established the Division of Forestry in 1876 solely to conduct research. Its assignment was to assess supplies of and demands for forest products and to study the preservation and restoration of the Nation's forests. Franklin B. Hough, a medical doctor, naturalist, historian, and statistician, was appointed to complete these broad tasks. Over the next 6 years, Hough published three lengthy *Reports Upon Forestry*, which advocated forest conservation as a national policy and supported establishment of forest reserves, which later became the National Forests.

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In 1905, the Division of Foresty was given responsibility for management of the forest reserves, and its name was changed to the "Forest Service." The need to manage these forest reserves captured most of the early attention of the Forest Service, but its research activities continued.

Forestry was a new profession in the United States in the early 1900's, and its practitioners began to ask questions that lacked satisfactory answers: How damaging are fires to American tree species? How can trees be established on slopes to prevent erosion? Are trees and cattle compatible? What are the best ways to establish new forests when old ones are harvested? It became clear that answers developed for European forests did not always apply to forests in the United States.

Forest Service scientists provided practical answers to these kinds of questions, not only for managers of national forests, but also for owners and managers of private forests. As a result, Forest Service scientists earned a reputation for solving practical management problems. The demand for more and better solutions led to the establishment of the regional experiment stations and Forest Products Laboratory, which still exist today.

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As the Earth's population and the demands it makes on forests have grown, so has the complexity of the problems facing forest managers. The research topics of forest scientists now are more varied and complex than those of their predecessors. Some current topics include effects of air pollution on trees, interactions between forests and global climate, restoration and management of tropical forests, water quality, protection of endangered species, preservation of biological diversity, intensive forest culture for wood production, and problems in recreation and wilderness management.

Our Scientists

The best way to understand Forest Service Research is through the work of our scientists. Our organization succeeds only to the extent that individual scientists make important discoveries. Our organization is designed for efficiency and creativity, and valuable support and guidance are provided by technical and administrative personnel. In the remainder of this publication, some of our leading scientists and their work are described.

Ariel Lugo

Dr. Ariel E. Lugo is Director of the Forest Service's Institute of Tropical Forestry in Rio Piedras, Puerto Rico. The Institute of Tropical Forestry is not very large, but the problems associated with tropical forests are. Scientists at the institute, therefore, must find the time and energy to make significant contributions on a wide range of urgent problems. Dr. Lugo has been instrumental in bringing to the institute a broad cooperative research program supported by grants and many outside institutions. With a colleague at the University of Illinois, Dr. Lugo is conducting comprehensive studies on the importance of tropical forests in the global carbon balance. He also is studying structure, function, dynamics, and succession in freshwater and saline forested wetlands with cooperators from the United States, Venezuela, and Argentina. A third area of research is on productivity, succession, and nutrient cycling in tropical tree plantations. Finally, he is studying the dynamics of tropical forests over a range in annual rainfall from 20 to 200 inches.

Ariel Lugo

In his research and his dealings with people, Dr. Lugo adds a large measure of humility to his commitment, discipline, and technical competence. The result is a down-to-earth manner that places him in heavy demand when people want to address problems in tropical forestry.

A native of Puerto Rico, he holds bachelor's and master's degrees in biology from the University of Puerto Rico and a doctorate in ecology from the University of North Carolina at Chapel Hill. In a little over 20 years as a full-time research scientist, he has authored more than 200 publications, most of them on ecological situations in Florida and the Tropics.

Tom Crow

Dr. Thomas R. Crow leads a North Central Station research project in Rhinelander, Wisconsin, that is developing the technology to view and preserve biological diversity from a landscape perspective. As one listens to Dr. Crow's description of his work, words like "enthusiasm" and "commitment" come to mind.

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Tom Crow

We must see the landscape as it appears from an airplane. Increasingly, what that view reveals are features created by human activities—cities, roads, agricultural fields, and patches of forest. What are the implications of these patterns on biological diversity? To answer that question, we study a variety of organisms—insects, understory plants, birds, and turtles—many of which foresters have traditionally ignored.

Landscapes in the United States are becoming increasingly fragmented. The process is benefiting some species while hurting others. Particularly vulnerable are species with low population densities, large home ranges, poor dispersal or colonizing abilities, limited range, or highly specialized habitat requirements. Dr. Crow and his coworkers are committed to creating forest landscapes that protect such species. "Unfortunately," he says, "most species that are threatened and endangered are not conspicuous, cute, or cuddly, and very few will contain organic compounds that are potential curing agents for humanity." Nevertheless, as he finds ways to protect them, one suspects that Dr. Crow will get his messages out.

Dr. Crow holds a bachelor's degree in forest management from Iowa State University, a master's degree in forest biology from the University of Michigan, and a doctorate in ecology from the University of Minnesota. He has been a Forest Service scientist since 1970.

Sue Conard

Dr. Susan G. Conard leads a large research project at the Pacific Southwest Station's Forest Fire Laboratory in Riverside, California. She also manages the nearby San Dimas Experimental Forest. Her project is studying fire effects in chaparral, woodland, and forest ecosystems. Most of the research focuses on Mediterranean-type ecosystems of the Pacific Coast, where natural and urban ecosystems experience long, dry summers, extended droughts, and severe fires. These fires can change vegetation patterns, accelerate erosion, cause severe flooding, and alter distribution and cycling of nutrients. The impacts are often increased by the resource demands and pollution from large urban populations. Dr. Conard and her colleagues have studied ecosystem responses to fire in Brazil and Yellowstone, as well as in southern California. The goal of their research is to gain a better understanding of how ecosystems react to disturbances such as fire and changing climate.

Sue Conard

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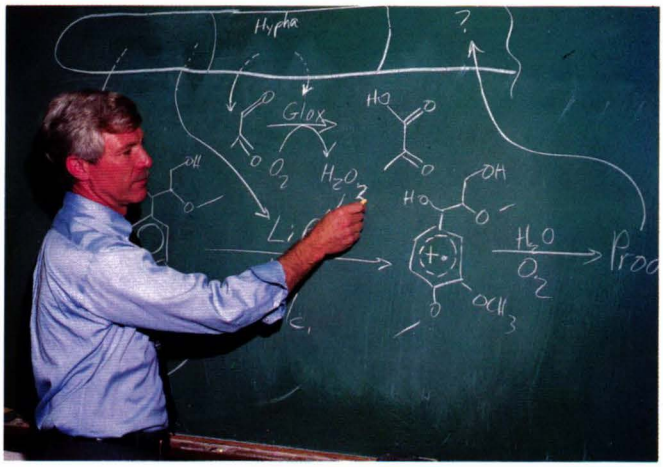
Dr. Conard holds a bachelor's degree in environmental studies from Antioch College in Ohio and

a master's degree and doctorate in ecology from the University of California at Davis. Her research career included work for Oregon State University and the British Columbia Ministry of Forests before she began working for the Forest Service in 1983. As an undergraduate, she studied sociology and anthropology, art history, and philosophy. This breadth serves her well as she grapples with national and international research issues and with the multiple duties involved in administering a large, interdisciplinary research project with over 25 employees. These duties leave only limited time—"never enough"—for her own studies.

Kent Kirk

Dr. T. Kent Kirk is Director of the Institute for Microbial and Biochemical Technology at the Forest Products Laboratory in Madison, Wisconsin. In his 21-year Forest Service career, he has been exploring the unique systems that wood-decay fungi have for degrading wood, and he has been looking for practical applications for those systems. During that period, the numbers of people who are interested in his work or are collaborating with him have grown steadily.



Kent Kirk

Current research focuses on the way in which fungi decompose lignin. A major component of wood, lignin is the complex plastic-like material that binds cellulose fibrils together in wood.

Dr. Kirk and his colleagues have found that fungi degrade lignin only when starved for nutrient nitrogen or carbon. They have discovered, isolated, and characterized the key enzymes of degradation and shown how those enzymes work. They have shown that fungi can be used to clean the wastewater from chemical pulping operations and to clean up soils contaminated with certain manmade chemicals. The institute is now exploring the possibility of "biopulping"—using lignin-degrading fungi to soften wood for mechanical pulping. It is hoped that the process will reduce the energy expended in pulping as well as produce stronger paper.

Dr. Kirk holds a bachelor's degree in forestry from Louisiana Polytechnic University and master's and Ph.D. degrees in biochemistry and plant pathology from North Carolina State University. He has authored more than 150 research publications, including 3 books, and he is the holder of 5 patents.

Durant McArthur

Dr. E. Durant McArthur leads an Intermountain Station shrub improvement research project at the Shrub Sciences Laboratory on the Brigham Young University Campus in Provo, Utah. A person who does not live in the intermountain West might easily wonder why anyone would want to improve wild shrubs, which look a good deal like what we call "brush" in the rest of the country. The answer is that these shrubs are a

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Durant McArthur

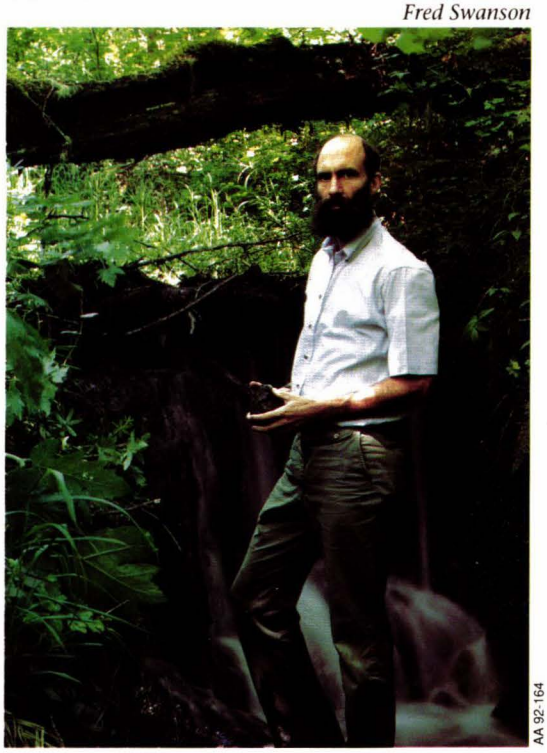
major food source for cattle and wildlife and the dominant vegetation over large areas. A major success in Dr. McArthur's research has been the hybridization of two subspecies of big sagebrush—one that grows rapidly and another that is highly palatable and nutritious for cattle. The hybrid is a plant that increases the productivity of cattle ranges. The shrub improvement project has developed many plant varieties for planting on degraded or unproductive rangeland. Ten of these varieties have been formally released for commercial seed production.

Dr. McArthur, a research geneticist, holds bachelor's and master's degrees and a doctorate from the University of Utah. As a Forest Service researcher since 1972, he has authored or coauthored some 200 publications, including proceedings from 6 symposia on shrub biology, genetics, and management. He attributes his success to persistence, innovation, and, most importantly, close working contacts with other scientists inside and outside the Forest Service.

Fred Swanson

Dr. Frederick J. Swanson, a geologist, leads a multidisciplinary ecosystem research group at the Pacific Northwest Station's H.J. Andrews Experimental Forest in the Willamette National Forest in Oregon. His own research has focused on the effects of forest management and natural disturbances, such as the 1980 eruptions of Mount St. Helens on soil erosion, stream channels, and ecosystems. His work is designed to understand the effects of geology on ecology.

Fred Swanson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As leader of an interdisciplinary group, however, Dr. Swanson says that he gets his greatest satisfaction in fostering ecosystem research by the group and seeing it broadly implemented.

> *It has been very exciting to work on this team of forest and stream ecologists, hydrologists, and land managers as we discover new things about natural ecosystems and consider their implications for land management. This interdisciplinary teamwork, involving researchers from the Forest Service, other agencies, and universities, has proven very effective in tackling new issues, such as interactions between forests and streams and the ecological effects of a changing global atmosphere.*

His group's ideas about forest stand and landscape management are being implemented on pilot tests in an innovative program that the Forest Service calls New Perspectives.

Dr. Swanson holds a bachelor's degree in geology from Pennsylvania State University and a doctorate in geology from the University of Oregon. He has been with the Forest Service for 14 years and has been involved with the Andrews Experimental Forest's scientific team for a total of 20 years.

Linda Joyce

Dr. Linda A. Joyce is a range scientist at the Rocky Mountain Station in Fort Collins, Colorado. In her 11-year research career, she has helped to develop mathematical models that consider needs for forage, wildlife, fish, and water when demands for and supplies of timber are estimated. As a result, the impacts of timber management on other resources can be estimated for forest regions.

Dr. Joyce recently completed an assessment of the long-term supply of and demand for range forage in the United States. By law, the Forest Service is required to make these periodic assessments of renewable resources produced by the Nation's forests and rangelands. The work is complex, but it forms the basis for long-term public policies on land use and management.

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Linda Joyce

At present, Dr. Joyce is collaborating with researchers at the Marine Biological Laboratory, Woods Hole, Massachusetts, and at universities in describing the probable effects of global climate change on supplies of renewable natural resources. She is determining how species and ecosystems respond to altered environments.

Her education prepared Dr. Joyce well for mathematical modeling of resource interactions. She holds a bachelor's degree in mathematics, a master's degree in environmental science, and a Ph.D. in range science from Colorado State University. She also spent a year as a visiting scientist at the Marine Biological Laboratory, where she explored the relationship between soil texture and nutrient cycling in grassland ecosystems.

Jack Ward Thomas

In his 34-year career as a wildlife biologist, Dr. Jack Ward Thomas has made a difference. In the best tradition of Forest Service research, he has stood calmly near the centers of controversial issues, providing sound biological data and conclusions. Most recently, Dr. Thomas led the Interagency Scientific Committee, which analyzed the situation of the northern spotted owl in Washington, Oregon, and northern California. The committee recommended major changes in the approach to management of the species' habitat on Federal land in the three States. If the recommendations are followed, cutting of old-growth timber there will be greatly reduced.

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Jack Ward Thomas

Dr. Thomas possesses a rare ability to organize and direct special task groups that examine very sensitive problems. During his career, he has served on task forces of the Society of American Foresters and The Wildlife Society to address old-growth forest issues. In addition, Dr. Thomas served on an ecological review team appointed by the Director of the Park Service and the Chief of the Forest Service to suggest management approaches after the widespread and intense fires in the Yellowstone area in the summer of 1988.

Dr. Thomas leads the Pacific Northwest Station's wildlife habitat and range research in La Grande, Oregon. He earned his academic credentials over an extended period. He received a bachelor's degree in wildlife management from Texas A&M University in 1957, a master's degree in wildlife biology from West Virginia University in 1969, and a Ph.D. in forestry from the University of Massachusetts in 1973. While he was in Amherst, Massachusetts, he specialized in wildlife habitat in urban and suburban areas and authored "Invite Wildlife to Your Backyard" for *National Wildlife* magazine. Over 2.5 million reprints of this article were distributed by the Forest Service and the National Wildlife Federation. He was also the editor/compiler/author of *Wildlife Habitats in Managed Forests—The Blue Mountains of Oregon and Washington*, which was the precursor of the Forest Service's ongoing Fish and Wildlife Habitat Relationships Program. Dr. Thomas later served as compiler/editor/author for the prize-winning *Elk of North America—Ecology and Management*, which has become known as "the elk bible."

Wayne Swank

Dr. Wayne T. Swank leads the Southeastern Station's ecosystems research at the Coweeta Hydrologic Laboratory near Franklin in western North Carolina. The research there features long-term studies of hydrological and ecological processes. Treatments are imposed on entire watersheds, and ecological changes are carefully observed. Instruments installed on the watersheds permit the precise measurement of water and nutrient inputs from precipitation and their movements through the ecosystem. Dr. Swank has received international recognition for his findings on the effects of management practices on water quality and nitrogen and sulfur cycling in forest ecosystems.

Wayne Swank

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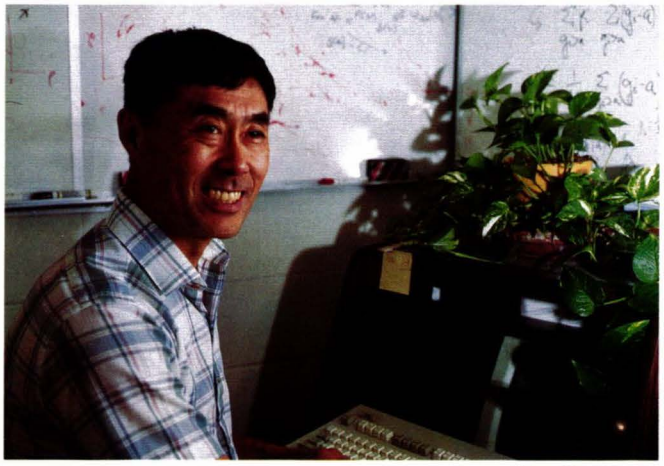
Dr. Swank holds a bachelor's degree in forestry from West Virginia University, and a master's degree and doctorate in forestry from the University of Washington. His Forest Service career in-

cludes experience as a forester in the Cascade Mountains before he came to Coweeta in 1966. He believes that the training and education of graduate students at Coweeta may prove to be its most durable contribution. In the last 25 years, more than 100 students have received master's degrees and doctorates from the University of Georgia and other institutions based on the research they did at Coweeta. Many of these alumni are now leaders in their fields.

Gene Namkoong

The complex and confusing topography on the border between population genetics and mathematics is home to Dr. Gene Namkoong. He leads the Southeastern Station's pioneering research effort on the population genetics of forest trees. In his work, mathematical procedures permit him to deal with the massive complexity involved in studying the fates of large numbers of individual genes in large populations.



Gene Namkoong

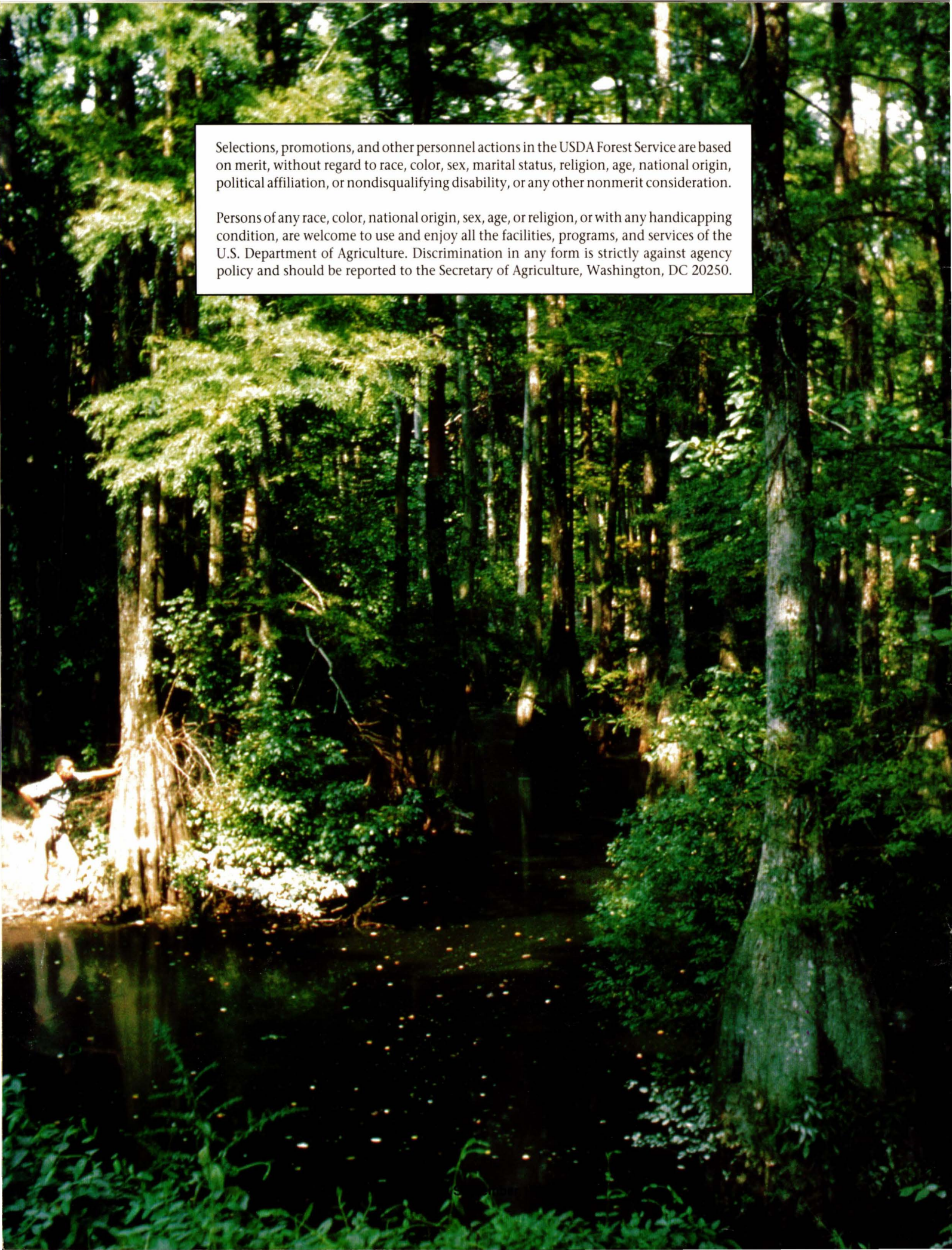
While Dr. Namkoong's methods may not be widely understood, his conclusions and recommendations are. Geneticists study the inherited differences between individuals of a species. Their knowledge is often used to breed new populations that are superior to the old in useful ways. In the process, however, much of the genetic variation of natural populations can be lost. In his 33-year Forest Service career, Dr. Namkoong has been an effective advocate for the conservation of genetic diversity. He was pleading the case for that form of biological diversity long before it was popular to do so. He showed that rich genetic diversity is necessary for the survival and evolution of tree species in changing environments. He also designed breeding systems that preserve genes while producing gains in desired traits.

He attributes his success to a two-step process:

1. Asking relatively simple, probing questions. Do organisms optimize their life cycles without accounting for their effects on their community? Are differences in behavior necessary for communities to function and for individuals to define themselves? Is biodiversity a necessary condition for life on Earth? Are diversity of thought and personality necessary for human life?

2. Finding and analyzing the data that can provide some answers.

In essence, he combines child-like curiosity and highly sophisticated analysis. Dr. Namkoong holds bachelor's and master's degrees in forestry from the New York State College of Forestry at Syracuse and a Ph.D. in genetics from North Carolina State University in Raleigh.



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